

between midnight and 4 a.m. saw no evidence of a display but sixteen Leonids and a few sporadic meteors. Several other observers who observed from Hampstead Heath on the Thursday morning early also reported no shower, but simply a meteor or two.

It must be concluded therefore that the expected shower did not arrive, or rather that the earth has not passed through any very dense portion of the swarm. It may be recollected that in the two preceding Novembers the Leonids were conspicuous by their absence, and this may practically be said of the recent display.

In addition to the above reports, the communications printed below have been received :—

Mr. E. C. Willis, of Ipswich, reports as follows :

*November 14:*

Time.	Meteors seen.	Remarks on weather.
	Leonids.	Others.
12 5 - 12 45	1	o
13 0 - 13 20	0	
14 0 - 14 25	1	o
16 45 - 17 0	10	4
17 0 - 17 15	4	1
17 15 - 17 30	8	3
17 30 - 17 45	12	6
17 50 - 18 5	2	2

Thick mist  
Very thick mist  
Thick mist  
Fine  
Fine, with some cloud  
Fine  
Fine  
Fine, sky much lighter

} Moonlight.  
} No moon.

*November 15.*—Observed occasionally from 11h. to 18h. The clouds at times covered the entire sky, while at times they were much broken up. No meteors were seen. The conditions were such that a brilliant shower could not have passed unobserved.

*November 16.*—Observed from 11.40 till 12.10. The sky was mostly covered with cloud. No meteors were seen.

The following notes by the Rev. Martin Wall, Fort Augustus, N.B., have been received from the Meteorological Office :—

"Great meteor" seen at 8.20 p.m., November 15. Flying with tremendous velocity south-east to north-west. Described, by an engineer, as a mass of flame of between 2 and 3 feet square ; in brilliancy like the arc-light ; leaving a trail of flame in its course, and lighting up the sky with a white light. It was seen by a second person to explode, over hill to north-west.

[N.B.—Indoors, where the electric light was burning, the diffused light of the meteor was distinctly noticeable.]

Two or three Leonid meteors were seen on the night of November 14 (one or two at 2 a.m., and one at 5.45) ; but the 15th and 16th were totally clouded over ; hence photographic preparations were of no avail.

[N.B.—Numerous ordinary meteors were also seen on the 14th.]

#### NOTES.

THE scientific lessons of the war are crowding upon us. We have already referred to the blunder made by our military authorities, in not sending Marconi apparatus to South Africa among the first equipments. We now learn indeed, after the investment of Ladysmith is drawing to a close, that Marconi apparatus is being sent out. The silence of Ladysmith during the last eventful weeks will point the moral, which is not likely to be forgotten in the future ; and it may well be that in the movements about to take place, in which the Ladysmith and the relieving force should be able to work in concert, the absence of a sure and rapid method of signalling, the absence of the Marconi apparatus, may render this difficult if not impossible. We have been informed on good authority that some time ago the importance of a locomotive search-light in operations of war was strongly represented to the military

authorities ; but they would have none of it. Fortunately, however, the naval force in Natal has now provided the army with one. It is certain to do good service.

THERE can be little doubt that the presence of another scientific instrument, the balloon at Ladysmith, has saved the situation. A moment's consideration of what this touch of science can do for us will indicate that the above expression is well grounded. Imagine two identical maps of Ladysmith and its surroundings, including the region dominated by our guns, carefully marked with squares, so that the position of any patch can be exactly defined by the rectangular coordinates shown at the side. A1, A20, &c., X6, Z30, Z40, &c. Imagine one of these in the hands of an officer who knows the ground thoroughly well, in the car of the captive balloon. He telephones the position of the enemy to the officer commanding the artillery down below, who is possessed of an identical map. From this he can at once determine the azimuth and range, and in a few minutes the shell may be fired in the required direction. The telephone of the balloon will inform the gunners how the shell has been dropped, and any directions regarding range can be given. It will therefore be impossible for the rebels, thanks to the balloon, to form in daylight in any large numbers for an attack on the camp, without rendering themselves liable to the searching fire of the guns. May we hope therefore that the balloon will also be used along the chief line of advance ? During a calm day it is possible that this scientific instrument may be far more valuable than an army of scouts, though the difficulties attending its working are fully recognised. Seeing then how important scientific instruments are in this struggle, in which millions are freely spent, we return to our question, how is it that there is no scientific committee to advise the Government in such matters, even if only to anticipate scientific applications ? and how is it that from the Grand Council of the nation, the Privy Council, men of science are rigorously excluded ?

A CONFERENCE of representatives of electric railway and electric tramway enterprises on the one hand, and representatives of the Government interested in the Greenwich and Kew Observatories on the other, was held at the Board of Trade on Wednesday in last week. The object of the conference was to ascertain the best means of dealing with the interference with the delicate instruments in the observatories by the leakage which there is reason to believe will follow from the introduction of large systems of electric traction. After Sir Courtenay Boyle had opened the proceedings, Prof. Rucker and the Astronomer Royal showed that magnetic instruments are seriously affected by the proximity of systems of electric traction ; but Sir Douglas Fox and Major Cardew would not admit that any interference with observatory instruments had at present been proved. As a result, a committee was appointed "to investigate the amount of magnetic disturbance produced in the neighbourhood of electric tramways and railways constructed and worked under the Board of Trade regulations ; and to report as early as possible." The committee consists of Profs. Rucker, Ayrton and Perry, representing the laboratories ; Prof. Kennedy, Mr. H. F. Parshall, Major Cardew and Mr. Brousson, for the electric traction companies ; and Mr. A. P. Trotter for the Board of Trade.

THE Paris correspondent of the *Chemist and Druggist* makes the following announcement :—The Professorship of Inorganic Chemistry at the Paris School of Pharmacy, vacant by the retirement of Prof. Riche, has been given to M. Henri Moissan. The latter's appointment as professor of toxicology at the School, which he already held, was perhaps due more to a very natural desire to attach the brilliant professor to the teaching staff than to poisons being his *forte*. He will now lecture on the subject that has practically been his life study. His first lesson on

Thursday afternoon of last week produced quite a little ovation, M. Moissan being loudly cheered by the large number of students present. He gave a short address on the career of Prof. Riche, and touched on the subject of electro-chemistry.

THE *Cecil Rhodes*—the first iron steamer designed for service on Lake Tanganyika—was launched at Wyvernhoe on Saturday. The steamer is to be employed primarily in laying the wires of the Cape to Cairo telegraph line along the shores of the lake. After the trial trip the boat will be dismantled and taken to pieces for shipment to Chinde, on the East Africa coast, whence she will be taken up the Zambezi and Shiré rivers by the Sharrers Zambezi Traffic Company, thence by native porters through Blantyre to Mpimbo, where she will be again shipped and carried across Lake Nyassa to Karonga, and finally taken overland along the Stephenson road to the south end of Lake Tanganyika, at which point she will be reconstructed and launched for the second time.

PROF. FERDINAND TIEMANN, honorary professor of chemistry in Berlin University, died on November 7.

DR. HENRY HICKS, F.R.S., the distinguished geologist, died on Saturday last, at the age of sixty-two.

THE death is announced, at Southport, of Mr. Alexander McDougall, who was widely known about sixty years ago in connection with the invention of the atmospheric railway, and has been associated since then with a long succession of mechanical and chemical appliances of public utility.

WE regret to see the announcement of the death of Dr. Camara Pestana, chief of the Bacteriological Institute at Lisbon. It was his verdict on specimens sent to him from Oporto for examination that conclusively established the existence of the plague there in August last. Dr. Pestana caught the plague while studying it at Oporto, and his death was due to that disease.

FROM the *Cape Times* we learn with regret that Prof. Francis Guthrie, until the end of last year professor of mathematics in the South African College, died on October 19. Prof. Guthrie was a brother of the late professor of physics at the Royal College of Science, South Kensington. He was born in 1831, and went out to Cape Colony in 1861 as professor of mathematics in the then newly-established Graaff-Reinet College. In 1875 he resigned his appointment at this college, and went to Cape Town. After a brief visit to England in 1876, he was appointed to the chair of mathematics in the South African College, then vacant by the retirement of the Rev. Prof. Childe. This appointment he held for twenty-one years, retiring from it in 1898. The Council of the college marked their appreciation of his long and honourable term of service by accordin a pension of double the amount to which he was legally entitled. Prof. Guthrie was deeply interested in botany; and he had the advantage of attending the lectures of John Lindley, an English botanist of high reputation. In Graaff-Reinet he gave, outside the college course, a series of public lectures; and on his removal to Cape Town, took up again more assiduously his botanical pursuits. Finally, he undertook, in conjunction with his life-long friend, Mr. Harry Bolus, the enormous task of a revision of the Order of the Heaths, for the next volume of the "Flora Capensis," now in course of preparation at Kew. Into this work he threw himself with all the ardour and enthusiasm of youth, and was engaged upon it up to a short period before his death.

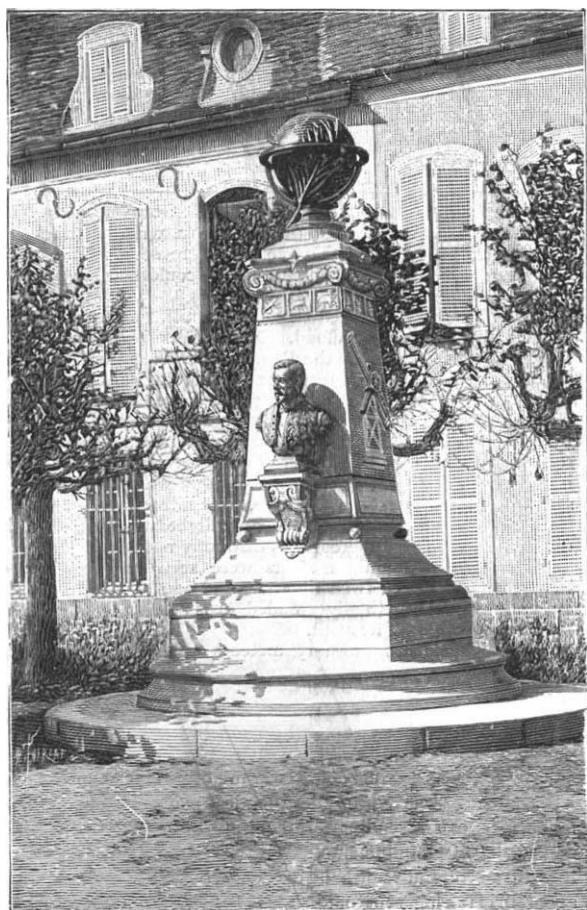
FELLOWS of the Physical Society, and their guests, dined together at the Hotel Cecil on Friday evening, November 17. The president of the society, Prof. O. J. Lodge, took the chair, and the guests included many distinguished men of science.

MR. STEWART CULIN, of the University of Pennsylvania, is preparing a memoir on the late Dr. D. G. Brinton, at the request of the family of the deceased anthropologist. He will be glad to receive letters and other literary materials bearing upon the subject of his memoir.

THE *British Medical Journal* states that Mr. J. W. Stephens and Dr. R. S. Christophers, members of the Royal Society expedition on malaria, have returned home, but they may possibly at a subsequent date proceed to the West Coast of Africa.

As a proof of his cordial sympathy with the cause of bird protection, the Poet Laureate, Mr. Alfred Austin, has written a special poem for the Christmas card which the Society for the Protection of Birds is issuing this year. It is entitled "Peace and Goodwill to the Birds," and is illustrated by a coloured picture of that much persecuted bird the tern, designed for the purpose by Mr. A. Thorburn.

A MONUMENT erected, by public subscription, to the memory of the lamented astronomer, M. Félix Tisserand, late director of the Paris Observatory, was unveiled at Nuits-Saint-Georges on



October 15, in the presence of a distinguished company of men of science. The accompanying illustration of the monument is given in *La Nature* with an account of the inauguration ceremony. Général Bassot, speaking on behalf of the Academy of Sciences, referred to Tisserand's scientific work. M. Poincaré spoke as the representative of the Bureau des Longitudes; M. Baillaud reminded the company of Tisserand's work at Toulouse; M. Callandreau spoke on behalf of the Société Astronomique;

M. Tannery in the name of the École Normale ; M. Bigourdan for old pupils ; and M. Löwy, the director of the Paris Observatory, as the representative of the Government and the Observatory. The French delight to honour their men of intellect ; but it is not often that a memorial of the kind erected to Tisserand is unveiled in honour of a man who has devoted his life to science in England.

FOUR years ago a scheme was drawn up by the late Dr. E. von Rebeur-Paschwitz for the organisation of the study of earthquakes over the whole globe. He obtained for it the support of all the leading seismologists, but his early death unfortunately delayed its execution. Prof. Gerland, on whom Von Rebeur's mantle has fallen in Germany, continues to support the scheme, and, having secured the approval of the Geographical Congress at Berlin, has issued a pamphlet in which he suggests the foundation of an international seismological society. The objects of the society would be to diffuse as far as possible the study of earthquakes in all countries, and especially in those which do not yet possess seismological stations ; to create a methodical organisation of microseismic observations ; and to centralise the publication of reports, which would appear in the form of supplements to the *Beiträge zur Geophysik*. It is also proposed that the Society should hold its general meeting conjointly with the International Congress of Geography.

MAJOR S. J. RENNIE describes in the *British Medical Journal* a grave case of snake-bite treated successfully with Calmette's antivenene serum. In concluding his account, he remarks : "That we have in Calmette's antivenene serum a most powerful remedy against the bites of venomous reptiles has been fully proved both in the laboratory, and also, in a few instances, in actual practice. In the year 1896 it fell to my lot to treat the first case in which this serum was used in India, and since then other successful cases have been reported. The case under consideration is, however, of especial interest, in that it proves, first, that no matter how acute the symptoms, or how far advanced the effects of the poison, it is never too late to use the antidote ; for, as will have been noted, the boy, in this instance, was, to all intents and purposes, dead at one time ; and, secondly, that the "antivenene" will keep for an almost indefinite period, and exposed to all vicissitudes of climate, as I had the serum used in this case in my possession in the plains of India for nearly four years."

THE annual report by the Board of Trade on their proceedings under the Weights and Measures Acts has just been issued as a Parliamentary paper. The report refers to the biennial meeting of the International Committee of Weights and Measures, which was held in Paris in April last, to consider the work undertaken at the bureau of the committee since the year 1897, and also to arrange the future proceedings at the bureau for the years 1899-1901. The committee was attended by representatives from various countries, including Great Britain, and was presided over by the president, Prof. W. Förster, director of the observatory at Berlin. The discussions at the numerous meetings of the committee, and the results of the inquiries by the committee into the administration of the bureau and the scientific investigations undertaken there by the director of the bureau, Dr. J. René-Benoit, have been published under the directions of the committee in the "Procès-Verbaux des Séances de 1899," and also in the "Travaux et Mémoires du Bureau International des Poids et Mesures." The report states that the Board of Trade are in communication with some Government departments with the view of ascertaining how far the metric system of weights and measures might be officially adopted in contracts. The Standards Department have in course of preparation, for the purpose of explaining the

principles of the metric system in schools, a set of educational models of metric weights, measures, and weighing and measuring instruments similar to those used in trade.

Two papers, dealing with the construction and equipment of the Waterloo and City Railway, were read at last week's meeting of the Institution of Civil Engineers. The first paper, by Mr. H. H. Dalrymple-Hay, was devoted to a description of the general features of the line, and the methods used in its construction. The new line is one and a half miles long, and, with the exception of a short length at Waterloo, consists of two iron tunnels with a station at each end, approached by stairs and inclines. The method of tunnelling in the London clay and in water-bearing strata was the well-known Greadhead system, except in the case of a short length of tunnel which was driven by a new method not requiring the employment of a heading or timbers outside the shield. The average rate of working in the small tunnels was ten feet every twenty-four hours where the tunnels were in the clay. In the larger tunnels at the City Station, which were also in the clay, six feet was completed regularly in the same time. In water-bearing strata, however, the speed varied greatly, depending upon the character of the ground and the depth of ballast and head of water at the face.

THE second paper, referred to above, by Mr. Bernard M. Jenkin, gave an account of the electrical equipment of the line, which is the second underground railway that has been built to be worked electrically. The electric energy is generated at the Power Station, at the Waterloo end of the line, by high-speed engines coupled direct to two-pole dynamos. The energy is transmitted to the trains by feeders connected to an insulated rail, or conductor, placed between the two running rails of the permanent way. Experiments and tests were made on completion of the line to ascertain the time and power taken to drive a train from one station to the other under different conditions and with different limits of speed on the sharp curves. The time in which a train could traverse the whole of the distance from one station to the other depends mainly upon the maximum speed which could be allowed on the sharpest curves. There are some very sharp curves at the bottom of the dip in the line where it passes under the river, and it was originally intended that the speed on these curves should be limited to twenty-four miles an hour. Before the line could be opened it was inspected by the Board of Trade, and Sir Francis Marindin decided to limit the speed round the sharpest curves to fifteen miles an hour instead of twenty-four miles an hour, for which the whole of the electrical equipment of the line was designed. This alteration has had naturally a very great effect on the whole working of the traffic on the line, the brakes having to be applied to the train on the down gradients, as the speed which would be attained by gravity alone would very much exceed the limit of fifteen miles an hour by the time the curves were reached. The switchback principle of working the line cannot, therefore, be adopted as it might otherwise have been with the particular arrangements of gradients and the absence of intermediate stations which is the peculiarity of the line described.

IN the few years that have intervened since the water of Niagara was first turned into the wheel-pit of the Niagara Falls Power Plant, a large number of entirely new industries have sprung up around, or within easy touch of, the power station. That the tendency is for the industries to gravitate to the power rather than the power to be transmitted to the industries is shown in an account given in the *Scientific American*, from which it appears that out of a total of 35,000 horse-power delivered from the station, over three-fourths are consumed in its vicinity, as against less than one-fourth that is transmitted to a distance—the principal long distance transmission being that

of 8000 horse-power to Buffalo, for the use of the Cataract Power and Conduit Company. It must not, however, be concluded that long distance transmission will not enter largely into the ultimate utilisation of the energy of Niagara. The remarkable installation recently opened in Southern California, where a transmission of eighty-three miles has been successfully accomplished, suggests that a large part of the 7½ millions of hydraulic horse-power available at Niagara Falls may yet be transformed and transmitted to the large cities of the eastern States. The present indications are, however, that for some time to come transmissions are not likely to be attempted for distances of over 100 miles.

THE success of the Naples Zoological Station in preserving marine animals for the purposes of both exhibition and study is so well known to all interested in museum work, that they will be prepared to welcome the translation by Mr. E. O. Hovey, which has recently appeared in the *Bulletin of the U. S. Museum* (No. 39), of Dr. Salvatore Lo Bianco's memoir on the methods employed in such preservation. It is to Dr. Lo Bianco himself that the exquisite results obtained are chiefly due; and the translator appends the following remarks on the secret of this success. "One reason for the beautiful appearance of the material sent out by the station is that it is properly caught in the first place; another is that, for the most part, the animals are alive when the process of preservation begins. With many forms it is indispensable that they be alive at the beginning of operations; with some it is not so necessary, but with all it is highly desirable. . . . The best methods have been determined for each species by itself, different species of the same genus often requiring different handling. . . . When new species are encountered, the best method of procedure must be determined by experiment." It is interesting to note that the author assigns to alcohol the first place as a preservative medium; adding that although formalin is a very useful liquid for keeping animals temporarily, it is less well suited for their permanent preservation.

LOCAL scientific societies often have a tendency to develop into societies for the promotion of penny readings and popular lectures; but the committees should always bear in mind that though interesting accounts of the scientific work of others may create a desire to know more of the facts of nature, the real value of a local scientific society must be judged by the facilities afforded for original observations, and the use the members make of them. The Preston Scientific Society, to judge by the annual report presented last week, not only encourages interest in science by means of lectures, but in each of its sections systematic studies and individual investigations are organised. A scheme for identifying and recording the flora of Preston and the neighbourhood was drawn up three years ago, and has been actively carried out during the past summer. Much new information has thus been gained, and in regard to the flowering plants it appears that the flora of the district was never so completely known as it is now. Mr. E. Dickson, who has been elected president for the ensuing year, pointed out in his address that this is the kind of work that can usefully be done by a local society, namely the investigation of local facts and phenomena. There is much to be done in the way of working out details of the natural history in every district, and the societies which stimulate activity in the required directions will assist in the advancement of scientific knowledge.

THE *Bulletin* of the Cracow Academy for July contains an important note of a mathematical character by Dr. Ladislaus Natanson on the thermokinetic properties of solutions. The present investigation appears to furnish a thermodynamical interpretation of Van't Hoff's molecular theories of osmotic pressure.

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WE have received the fourth report of the International Commission of Glaciers. The report is entirely devoted to records of glacier measurements made in various parts of the world during 1898; it forms a substantial addition to our knowledge of glacier movements and their periodic variations.

THE new *Bulletin de la Société de Géographie* contains a number of papers of more than average interest. Mr. F. J. Clozel contributes a historical paper on the Ivory Coast; Captain Chanoine writes on the Voulet-Chanoine Mission; Dr. Huguet describes the physical geography of Southern Algeria in a paper illustrated by some rough but suggestive sketches of sand-dunes. There is an account by Dmitri Klementz of travels in Western Mongolia in 1885 and 1897, and the first part of an important paper on the Meteorology of Palestine and Syria, by Father R. P. Zumoffen, S.J.

WE have received parts 1-3 of vol. xxi of the *Transactions and Proceedings* of the Botanical Society of Edinburgh (1897-1899), which contain several interesting articles, especially on the structure and microscopical examination of woods, recent and fossil, viz.:—On the histological structure of fossil woods, by Mr. R. A. Robertson; on a method of injection-staining plant vascular systems; on contact negatives for the comparative study of woods; and on the histology of some fossil woods, by the same writer. Mr. R. Stewart McDougall has a paper on the bacteria of the soil, with special reference to soil inoculation; Mr. R. Turnbull, one on *Apodya lactea*, a fungus belonging to the Saprolegniaceæ; Mr. Percy Groom, one on the fusion of nuclei among plants, and Mr. R. A. Robertson, one on abnormal conjugation in *Spirogyra*.

OUR German contemporary *Globus* is always interesting, and it is a great pity that there is no journal on similar lines in the English language. The following articles in recent numbers are well worth reading: "The Philipponens of Ostpreussen" (vol. lxxvi. No. 12) gives an account of the houses, mode of life, and religious beliefs of a strange Christian sect that was established about 1700 by Philip Pustoswiat. "The Onondaga Indians of New York State, and the Sagas of the foundation of the confederation of the five nations by Hiawatha" (Nos. 13, 14). "Indian and Singhalese Children and their Games" is a welcome addition to a neglected subject; there are several illustrations (Nos. 14, 15). R. Schumacher gives (No. 15) an illustrated ethnographical account of a recent travel among the uncivilised Tschin-huan who live in the high and hard-to-reach mountains of Formosa; the author does not believe that they are an aboriginal population (No. 14). "Folk-lore among the Huzulen" (Nos. 15, 16, 17). Dr. H. Jansen gives (No. 17) a valuable illustrated résumé of recent ethnographical, anthropological, and archaeological work in Portugal. We would call attention to the illustrations of existing pile dwellings.

MESSRS. WILLIAM WESLEY AND SON have sent us a catalogue of books and pamphlets on modern astronomy, which is a model of clear and orderly arrangement. The catalogue is limited to astronomical literature of the nineteenth century, and includes 2240 titles, arranged under thirty-three heads and sub-heads. The classification adopted is particularly convenient, and it enables an astronomer to find at once the works in the list bearing upon the branch of celestial science in which he takes special interest.

THE additions to the Zoological Society's Gardens during the past week include a Diana Monkey (*Cercopithecus diana*, ♂) from West Africa, presented by Mr. E. F. Martin; a Spotted Ichneumon (*Herpestes auro-punctatus*) from Busreh, presented by Mr. B. F. Finch; two Dusty Ichneumons (*Herpestes pulverulentus*), a Cape Crowned Crane (*Balearica regulorum*) from

South Africa, presented by the Trustees of the South African Museum; two Schalow's Touracous (*Turacus schalowi*), four Cape Turtle Doves (*Turtur capicola*) from South Africa, presented by Mr. W. L. Sclater; a Vulturine Eagle (*Aquila verreauxii*) from South Africa, presented by the Rev. D. Kolbe; a Tawny Eagle (*Aquila nobivoides*) from South Africa, presented by Mr. Claude Southe; a White-tailed Gnu (*Connochaetus gnu*, ♂) from South Africa, presented by Mr. C. D. Rudd; two Mandrills (*Cynocephalus mormon*, ♂♂), two White-collared Mangabeys (*Cercocebus collaris*, ♂♀), a Tantalus Monkey (*Cercopithecus tantalus*, ♂), a Lucan's Crested Eagle (*Lophotriorchis lucani*) from West Africa, a Spring-Bok (*Gazella eudorcas*, ♂) from South Africa, a White-tailed Ichneumon (*Herpestes albicauda*) from the Atbara River, a Yellow-headed Conure (*Conurus jendaya*) from South-east Brazil, four Lesser Pin-tailed Sand-Grouse (*Pterocles exustus*), a Black-headed Partridge (*Caccabis melanocephala*) from Arabia, deposited; a Roi Rhe-Bok (*Cervicapra fulvo-rufula*, ♂) from Maryland, Schomburg Station, Cape Colony, a Gannet (*Sula bassana*), British, purchased.

#### OUR ASTRONOMICAL COLUMN.

HOLMES' COMET (1899 d).

*Ephemeris for 12h. Greenwich Mean Time.*

1899.	R.A.	Decl.
h. m. s.		
Nov. 23	2 13 55·17	+47° 40' 0·2"
24	3 6·67	32° 36' 4"
25	12 20·16	25° 1' 7"
26	11 35·67	17° 16' 9"
27	10 53·25	9° 22' 5"
28	10 12·94	47° 1° 19' 5"
29	9 34·75	46° 53' 8·4"
30	2 8 58·72	+46° 44' 50"

COMET GIACOBINI (1899 e).—Several observations of this comet having been obtained, Herr S. K. Winther continues his ephemeris in the *Astronomische Nachrichten* (Bd. 150, No. 3600):—

*Ephemeris for 12h. Berlin Mean Time.*

1899.	R.A.	Decl.	Br.
h. m. s.			
Nov. 23	17 52 33	+10° 17' 6"	
24	54 12	10° 34' 0" ... 0·50	
25	55 52	10° 50' 5"	
26	57 32	11° 7' 0"	
27	17 59 12	11° 23' 6"	
28	18 0 52	11° 40' 2" ... 0·48	
29	2 33	11° 56' 9"	
30	18 4 13	+12° 13' 7"	

During the week the comet passes from the northern part of Ophiuchus into Hercules, about 6° east of a Ophinch.

REFRACTION EFFECT OF COMET SWIFT (1899 I).—Prof. C. D. Perrine, during May and June 1899, made several attempts to determine if any appreciable refraction was caused by the body of Swift's comet on a ray of light passing through it, and contributes his conclusions to the *Astronomische Nachrichten* (Bd. 150, No. 3602). The observations were made with the 36-inch Lick refractor, and consisted of determining accurately the position angle and distance of two stars, (1) when one or both of them were seen enveloped in the mass of the comet; (2) when quite free from the cometary matter. The diameter of the head of the comet was computed to be about 174,000 miles, and the extent of matter traversed by the light from the stars about 163,000 miles. The greatest range of variation in the measured distance of the stars was 0°·26, which the author thinks in all probability accidental, as no systematic variation was detected; so that from these experiments the conclusion is that the mass of a comet causes no appreciable effect of refraction on light passing through it.

PREDOMINANCE OF SPIRAL NEBULÆ.—In the *Astronomische Nachrichten* (Bd. 150, No. 3601), Prof. J. E. Keeler describes the preliminary results of his inquiry into the structure of nebulae.

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The discussion is based on photographs obtained with the Crossley reflector of the Lick Observatory, and the author finds that in addition to confirming the spiral structure of the nebulae catalogued by the Earl of Rosse, so many others possess the same characteristic form that their being put in a special category loses its significance; in fact, any small compact nebula not showing evidence of spiral structure, appears exceptional. He finds gradations leading to the belief that the elongated spindle-shaped nebulae of Herschel also really belong to this class. The author concludes by stating that if numerous exceptions prove that spirality in nebulae is not an universal law, it may perhaps be regarded as the usual or normal accompaniment of contraction in cosmical masses, and any departure from it may be explained as the result of special conditions, tending to suspend or weaken causes which are generally in operation.

BULLETIN ASTRONOMIQUE.—The *Bulletin Astronomique* for November 1899 contains an illustrated article by M. Camille Flammarion on the "Eclipses of the Twentieth Century visible at Paris." Forty-three eclipses of the sun will be visible, two of them being total, and thirty-three presented in good positions for observation. The particulars of each are given, with a diagram showing maximum phase. The same author describes the observations of 339 Perseids made at Juvisy from 10-13 August 1899, with illustrations showing the plotted paths. The mean position of the radiant was RA = 3h. 3m.; Decl. +56°.—M. Souleyre concludes his article on the "Distribution of rain on the earth's surface."—M. A. Benoit contributes a very interesting article on "Transneptunian planets," giving particulars respecting a proposed instrumental equipment for a systematic search for such bodies.

#### THE FITTING OF THE CYCLE TO ITS RIDER.<sup>1</sup>

THE present time is opportune to notice some points in cycle riding which have received our attention during the last three years. Every intelligent rider of a cycle must have at some time compared his powers as a human motor with the motors that drive the motor-cars which he now so frequently meets in the streets. He naturally wishes to study the question of most efficient propulsion, including that of his own mechanical efficiency as a motor driving his cycle. The design of the modern cycle was so far developed by 1896 that a standard type then became the rule, most cycles having a 45-inch wheel base, two wheels of equal diameter 28 inches, cranks 6½ inches long, and a ratio of gear varying between 59 to 80 inches, the sole difference made between cycles intended for tall riders and those for short ones consisting in varying the height of the frame. In 1896 the writers, being urged thereto by Mr. Otto Blathy, the well-known engineer of Budapest, had their attention called to the necessity of varying the crank length to suit the varying length of leg of the rider. A series of experiments was carried out for cranks up to 9½ inches long, and the results obtained were very remarkable. It may now be taken as admitted that a very large proportion of the riders who have tried cranks of increased length have found great benefit from their use, but although they feel strongly how tangible these advantages are, some difficulty has been felt in satisfactorily explaining them.

All that has been written on cycle riding in the past has been confined to the style of riding which has been gradually elaborated on cycles fitted with the standard 6½-inch to 6¾-inch cranks, but this is little or no assistance to us when we attempt to investigate the subject through wider limits of muscular movement.

When mechanical engineers measure the efficiency of any form of mechanical motor they confine themselves generally to the consideration of the fuel that it consumes, but do not, as a rule, when considering its efficiency, take into consideration the cost of keeping it in repair, or include with it the cost of feeding and maintaining the driver; but the food which is the fuel of the cycle rider has not only to perform the same duties as the fuel of the mechanical motor, but has in addition to supply the nerve waste and repair the muscle waste which answers to the repairs to the mechanical motor, and from the same supply to maintain the brain power of the driver. The food energy of the cyclist has, therefore, to be distributed through three distinct channels: the first in importance is that which is required

<sup>1</sup> Abstract of paper read before the Cycle Engineers Institute at Birmingham, by R. E. Crompton and C. Crompton.